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PATENT ABSTRACTS OF JAPAN

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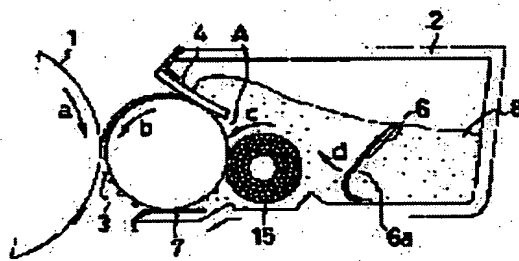
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(54) DEVELOPING DEVICE

(57)Abstract:

PURPOSE: To faithfully realize a solid image having high density and wide area without causing irregularity and fogging by preventing toner which is one-component developer from flocculating in the vicinity of a part where an elastic controlling member abuts on the developer carrier and preventing the toner from being supplied too much in the vicinity of the elastic controlling member even though a developing device is left under a high humidity condition for a long time, or kept being used for copying an original whose image ratio is low.

CONSTITUTION: One of or both of an elastic roller 15 rotating in the same direction as that of a developing sleeve 3, peeling undeveloped toner on the sleeve 3, and supplying new toner 8, and a toner feeding member 6 rotating in a direction opposite to that of the roller 15, supplying the toner 8 in a developing container 2 in the direction of the roller 15 is/are rotated in the direction opposite to the direction at the time of developing when the developing is not performed. Therefore, the toner



is prevented from accumulating in the vicinity of the part where the elastic blade 4 abuts on the sleeve 3, etc., by the opposite rotation of one of or both of the roller 15 and a feeding member 6 when the developing is not performed.

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CLAIMS

[Claim(s)]

[Claim 1] Developer support conveyed to image support and the development section which countered by supporting a developer and rotating in a development container which held a 1 component developer Elastic specification-part material which regulates an amount of a developer supported on developer support in contact with developer support 1st developer feed zone material which supplies a new developer while stripping off a developer which is not developed [which remained by development in the development section by contacting developer support by the hand-of-cut upstream, and rotating in this direction] from developer support 2nd developer feed zone material supplied in the 1st direction of developer feed zone material by rotating a developer in a development container It is the developer equipped with the above and is characterized by carrying out inverse rotation in between [after starting image formation actuation for one side of the said 1st and 2nd developer feed zone material, or both, until it starts development actuation, or until / after ending development actuation, / it ends image formation actuation / one / at least].

[Claim 2] Developer support conveyed to image support and the development section which countered by supporting a developer and rotating in a development container which held a 1 component developer Elastic specification-part material which regulates an amount of a developer supported on developer support in contact with developer support Developer feed zone material which supplies a new developer while stripping off a developer which is not developed [which remained by development in the development section by contacting developer support by the hand-of-cut upstream, and rotating in this direction] from developer support A closure member which closes a developer in a development container in contact with developer support It is the developer equipped with the above, and it is made to serve as a charge grant member which gives a frictional electrification charge of the frictional electrification polarity and antipole nature to said closure member to a developer which is not developed on developer support, and is characterized by installing the closure member between said development section and the contact section of developer feed zone material.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the developer developed especially using a 1 component developer about the developer used for developing and visualizing the latent image formed on the image support which consists of an electrophotography photo conductor, an electrostatic recording dielectric, etc. in a reproducing unit, an image display device, image recording equipment, a printer, or facsimile.

[0002]

[Description of the Prior Art] In image formation equipments, such as a reproducing unit, an image display device, image recording equipment, a printer, and facsimile, it is performing developing with a developer the latent image formed on the image support which consists of an electrophotography photo conductor, an electrostatic recording dielectric, etc., and visualizing it as a toner image.

[0003] As one of such the developers, a dry type 1 component developer is proposed variously, and is put in practical use again. However, it is very difficult to form the thin layer of the toner of a 1 component developer on developer support with any developer. it is alike, and the development about current [appropriate / which is asked for the improvement in the visibility of an image, resolution, etc.], the thin layer forming method of a toner, and its equipment has become indispensable, it has responded to this and the policy of shoes is proposed.

[0004] For example, in JP,54-43038,A, by making a development sleeve carry out light pressure contact of rubber or the metaled elastic blade, passing the nip section of the above-mentioned contact section, and regulating the toner supported on the development sleeve, the thin layer of a toner is formed on a development sleeve, and sufficient amount of frictional electrification charges for a toner is given by friction there.

[0005] Moreover, when regulating a nonmagnetic toner with an elastic blade, toner feed zone material is needed separately. Although it can supply a toner on a development sleeve by the magnetism of the magnet in a development sleeve in a magnetic toner, since this cannot do it, it needs mechanical toner feed zone material with the nonmagnetic toner.

[0006] Then, these people proposed the developer shown in drawing 7 (JP,58-116559,A). The roller 5 of the fur brush structure which contacts the development sleeve 3 in the location of the hand-of-cut upstream of the development sleeve 3 is arranged, and stripping of the toner 8 which is not developed on the development sleeve 3 and the new toner 8 to the development sleeve 3 top are made to supply with a roller 5 rather than the elastic blade 4 in the developer of this proposal in the development container 2 which held the nonmagnetic toner 8.

[0007] Also when a toner 8 was a nonmagnetic toner according to this, the thin layer of a toner 8 could be formed good on the development sleeve 3, the electrostatic latent image on a photoconductor drum 1 could be developed, the solid black image of high concentration and extensive area was faithfully reproduced by development, and it became possible to always be stabilized and to obtain an image without a sleeve ghost. Moreover, it became possible to attain simplification of a developer.

[0008]

[Problem(s) to be Solved by the Invention] By the way, the reproducing unit which contains the miniaturization of the developer itself or two or more developers in a compact, and forms the image of two or more colors is required, and the developer of broadside arrangement as shown in drawing 8 is demanded in recent years.

[0009] the rotational frequency with the same elastic roller 15 which is the 1st developer supply means of such a developer -- supply of the toner 8 to the development sleeve 3 top -- enough -- it can carry out -- and the toner non-developed negatives -- also stripping off -- a hand of cut is carried out in the direction of arrow head c, and relative velocity with the development sleeve 3 is enlarged so that it can carry out certainly. The toner delivery member 6 which is the developer supply means of **** 2 is also rotated in the direction of arrow head d by the same reason.

[0010] Making it be the above, by things, although the solid image of high concentration and extensive area can be faithfully reproduced also in the developer of broadside arrangement, the following troubles were produced under a certain specific conditions.

(1) In the developer of the above-mentioned broadside arrangement, when the toner for low-temperature fixing was used for the purpose of the quick start of copy actuation, as compared with a toner, there was a case where blocking of a toner arose near the contact section of the elastic blade 4, and the large image of nonuniformity or fogging arose since whenever [condensation] is high, conventionally.

(2) In the developer of broadside arrangement, when it was left for a long period of time or continued copying a manuscript with a low image ratio under the high-humidity environment to the bottom of a high-humidity environment, compared with the amount of toners which development takes, the about four elastic blade toner amount of supply became excessive, and the same phenomenon as the above (1) arose.

[0011] Even if it prevents, and leaves equipment for a long period of time or continues using it for the copy of the manuscript of a low image ratio under a high-humidity environment, that the toner of a 1 component developer condenses the purpose of this invention near the contact section with the developer support of elastic specification-part material. It is preventing producing the excess of the amount of supply of the toner near the elastic specification-part material, and offering the developer which enabled it to reproduce the solid image of high concentration and extensive area faithfully, without producing nonuniformity and fogging.

[0012]

[Means for Solving the Problem] The above-mentioned purpose is attained by developer concerning this invention. Developer support conveyed to image support and the development section which countered by this invention's supporting a developer in a development container which held a 1 component developer, and rotating if it summarizes, Elastic specification-part material which regulates an amount of a developer supported on developer support in contact with developer support, and by contacting developer support by the hand-of-cut upstream, and rotating in this direction. The 1st developer feed zone material which supplies a new developer while stripping off a developer which is not developed [which remained by development in the development section] from developer support, In a developer equipped with the 2nd developer feed zone material supplied in the 1st direction of developer feed zone material by rotating a developer in a development container. It is the developer characterized by carrying out inverse rotation in between [after starting image formation actuation for one side of the said 1st and 2nd developer feed zone material, or both, until it starts development actuation, or until / after ending development actuation, / it ends image formation actuation / one / at least].

[0013] Moreover, developer support conveyed to image support and the development section which countered by this invention's supporting a developer in a development container which held a 1 component developer, and rotating, Elastic specification-part material which regulates an amount of a developer supported on developer support in contact with developer support, and by contacting developer support by the hand-of-cut upstream, and rotating in this direction. In a developer equipped with developer feed zone material which supplies a new developer while stripping off a developer which is not developed [which remained by development in the development section] from developer support,

and a closure member which closes a developer in a development container in contact with developer support. It is the developer characterized by having made it serve as a charge grant member which gives a frictional electrification charge of the frictional electrification polarity and antipole nature to said closure member to a developer which is not developed on developer support, and installing the closure member between said development section and the contact section of developer feed zone material.

[0014]

[Example]

Example 1 drawing 1 is the cross section showing the outline configuration of the example 1 of the developer of this invention. The developer of drawing 1 expresses the condition at the time of development actuation.

[0015] This developer develops the electrostatic latent image on the photo conductor 1 as image support which rotates in the direction of drawing Nakaya mark a. A photo conductor 1 is the member which can form and hold an electrostatic latent image (or potential latent image) or a magnetic latent image by the insulating material which imprints an electrostatic latent image and is formed with the so-called zero graph photo conductor which forms an electrostatic latent image for example, according to the Carlsson process, the photo conductor which forms an electrostatic latent image in the surface given in a JP,42-23910,B official report according to NP process with an insulating layer, the insulating material which forms a latent image by the electrostatic recording method, and a replica method, and other proper methods.

[0016] The developer of this example is equipped with the development sleeve 3 as developer support, the elastic blade 4 as developer specification-part material, the elastic roller 15 as 1st developer supply means, and the toner delivery member 6 as 2nd developer supply means in the development container 2 which held the nonmagnetic toner 8 as a 1 component developer, as shown in drawing 1.

[0017] The development container 2 has the opening which extends in the part which met the photo conductor 1 at the longitudinal direction (direction perpendicular to space) of a developer, and the above-mentioned development sleeve 3 sees by a diagram, and rushes in a right semicircle side into a container 2, a left semicircle side is exposed from the outside of a container 2, and as it opens a small gap in a photo conductor 1 and attends the opening, it is installed in it free [rotation]. The development sleeve 3 consists of non-magnetic materials, such as aluminum, and has become that a rotation drive carried out in the direction of arrow head b.

[0018] The elastic blade 4 is formed in the location of the abbreviation crowning of the development sleeve 3 of the development container 2, and it is contacted so that it may incline to the hand-of-cut downstream of the development sleeve 3 and the peripheral surface may be countered with a hand of cut. In contact with the peripheral surface of the development sleeve 3, the elastic roller 15 is supported so that it may be pivotable in the direction of arrow head c, and the contact section is located in the hand-of-cut upstream of the development sleeve 3 rather than the contact section with the development sleeve of a blade 4.

[0019] The toner delivery member 6 consists of a rotation member which prepared wing 6a of a flexible sheet at the tip, and is rotated in the direction of arrow head d.

[0020] The seal member 7 which prevents leakage **** of the toner 8 from a container 2 is installed in the lower part of opening of the development container 2. By fixing the end to the lower part of the opening of a container 2, the seal member 7 is energized elastically and contacted by the lower part of the development sleeve 2.

[0021] Actuation of the developer of this example is explained. The toner 8 in the development container 2 is supplied to the development sleeve 3 by rotation of development working and the elastic roller 15. The toner 8 is conveyed by rotation of the development sleeve 3, and it invades into the contact section of the development sleeve 3 and a blade 4. In case the contact section is passed, both the development sleeve 3 and the blade 4 ****, enough frictional electrification charges are given, and it is formed on the development sleeve 3 of regulation with a blade 4 at a thin layer-like toner layer. Thus, a toner 8 slips out electrification and regulation of that after a carrier beam in the above-mentioned contact section, and is carried to a photo conductor 1 and the development section which counters with rotation

of the development sleeve 3.

[0022] In the development section, a part is consumed by development actuation and close is returned [the toner 8 on the development sleeve 3] for the remainder of a toner 8 in the development container 2 from the lower part by rotation of the development sleeve 3. The seal member 7 of the lower part of development container 2 opening prevents that the toner 8 in the development container 2 leaks out from the lower part of a container 2 while permitting passage into the development container 2 of the toner 8 which was not consumed in development.

[0023] The toner 8 returned in the above-mentioned development container 2 is stripped off from the development sleeve 3 in the contact section with the development sleeve 3 with the elastic roller 15. The new toner 8 in the development container 2 is supplied by rotation of the elastic roller 15 on the development sleeve 3 at coincidence, and the new toner 8 is again conveyed with rotation of the development sleeve 3 to the contact section of the development sleeve 3 and the elastic blade 14.

[0024] On the other hand, most toners 8 with which the above was stripped off are conveyed in the toner 8 in the development container 2 with rotation of the elastic roller 15, it is mixed, and the electrification charge of the stripped-off toner 8 is distributed.

[0025] Although the toner 8 on the development sleeve 3 produces substitution by rotation of the elastic roller 15 as mentioned above, as the conventional part described, under specific conditions, a toner 8 may condense to the space (field shown all over [A] drawing) surrounded by the blade 4, the development sleeve 3, and the elastic roller 15 near the contact section with the development sleeve 3 of a blade 4 (blocking).

[0026] Then, the time of development makes hard flow rotate the elastic roller 15 in the direction of arrow head e in this example, in between [after starting at the time of un-developing negatives, i.e., image formation actuation, until it starts development actuation or until / after ending development actuation, / it ends image formation actuation / one / at least], as shown in drawing 2.

[0027] Since the superfluous toner collected on the A section in drawing is completely returned in the toner delivery member 6 direction of the 2nd supply means according to the inverse rotation of such an elastic roller 15, it is fully mixed with the toner 8 in a container 2, and condensation of a toner does not occur in the A section. Moreover, even if it leaves a developer under a high-humidity environment for a long period of time or continues using it for the copy of the manuscript of a low image ratio, a toner 8 is not superfluously supplied near the elastic blade 4. Therefore, the solid image of high concentration and extensive area can be reproduced faithfully, without producing nonuniformity and fogging.

[0028] In the above, although plugging of the toner to the A section will not be produced whenever it rotates the elastic roller 15 in the direction of arrow head e during development actuation, but sufficient concentration is securable if it is a manuscript with a low image ratio, flattery nature, such as a solid black image of extensive area, has got worse. In this example, since it rotates reversely only at the time of un-developing negatives, solid black flattery nature does not get worse and a good image can be obtained.

[0029] As long as responsibility avoids the inverse rotation of this elastic roller 15 to copy actuation, it may be performed by what kind of method. For example, at the time of development, between the drive gear of the development sleeve 3 and the drive gears of the elastic roller 15 is connected through one gear, after development actuation termination, the gear separates from an equipment halt and it should just be carried out to a configuration which the gear of the development sleeve 3 and the gear of the elastic roller 15 connect directly, and rotate reversely.

[0030] As an elastic roller 15 which is the 1st supply means, the sponge roller of the shape of comparatively low skeletal structure of whenever [foaming] is desirable. In this example, what was twisted centering on urethane foam (density 0.025 g/cm³) with a thickness of 5mm was used. Although the elastic roller 15 which consists of this sponge roller contacted the development sleeve 3 at software, as that contact width of face, its 1-10mm was effective, and set it to 3mm by this example.

[0031] Moreover, in order to raise the stripping force of the toner which is not developed on the development sleeve 3, the peripheral speed of the elastic roller 15 at the time of development is effective if relative velocity with the development sleeve 3 in the contact section is carried out [second] in 5-

600mm / . In this example, it carried out in 120mm/second. At the time of inverse rotation, the relative velocity with the sleeve peripheral speed in the contact section of the elastic roller 15 had an effective second in 0-100mm /in the absolute value, and was made for what is necessary to be just to be able to return the toner which collects on the A section at the time of development to the delivery member 6 side in 40mm/second by this example.

[0032] The thing of the fur brush structure which transplanted hair in the rayon fiber etc. as a member of the elastic roller 15 may be used, and the same effect is acquired.

[0033] Wing 6a of the toner delivery member 6 of the 2nd supply means has an effective thing with length to the extent that it consists of flexible sheets, such as PET, urethane, and polyimide, and the A section of drawing is reached as 15-75 micrometers and free length as thickness. In this example, wing 6a used the PET film with a thickness of 38 micrometers.

[0034] In order to raise toner conveyance nature, using a cylinder object or belt objects, such as metals, such as SUS and aluminum, and various resin, and rubber, as a development sleeve 3, what split-face--ization-processed surface Rz to 0.5-5.0 micrometers is effective. In this example, what carried out blast processing with the fixed form bead of #600 on the surface with an outer diameter of 16mm of an aluminum sleeve, and set surface roughness Rz to 1.5-3.0 micrometers was used.

[0035] As an elastic blade 4, various rubber, such as urethane with a JIS degree of hardness of 40-80 degrees, silicon, a fluorine, a chloroprene, or metal distribution rubber, can be used, for example, and a thing with a degree of hardness of 50-70 degrees is good because of [desirable] formation with a stable developer thin layer. In this example, silicone rubber with a degree of hardness of 65 degrees was used for the elastic blade.

[0036] This elastic blade 4 is energized so that that edge may contact the development sleeve 3. Any of the tip of a blade 4, its near or a tip, and its near are sufficient as the edge of a blade 4. The contact pressure with the development sleeve 3 of the elastic blade 4 had effective 5 - 200 g/cm (linear pressure of the direction of a sleeve bus-bar), and it made it 20 g/cm by this example.

[0037] Specifically in this example, the toner which ** (ed) colloidal silica 1.5% outside was used for toner fine particles with a mean particle diameter of 12 micrometers which consists of the copolymer and pigment of styrene/acrylic resin, and styrene butadiene resins, using a nonmagnetic toner as a toner 8. When this was supplied to the development sleeve 3 with the elastic roller 15, it regulated with the elastic blade 4 and the thin layer of a toner 8 was formed on the development sleeve 3, the toner thin layer of about 30-micrometer thickness was able to be formed in homogeneity. When the amount of electrifications of this toner thin layer was measured by the blowing off method, the amount of charges is +15microC/g, and sufficient value was acquired.

[0038] As the development method used here, a method given in JP,58-32375,B is desirable. Although development bias may be impressed between a photo conductor 1 and the development sleeve 3 and alternating voltage or direct current voltage is sufficient as bias, the mutual voltage which superimposed the direct current on the alternating current is desirable. The development method may be a method which it is not restricted [method] to this and contacts a developer thin layer to a photo conductor 1.

[0039] It includes in copying machine FC-2. the developer of this example of the above configuration -- the Canon, Inc. make -- The surface potential of the electrostatic latent image on the photo conductor 1 which consists of an organic photo conductor Umbra-540V, It is referred to as bright section-150V and the gap between a photo conductor 1 and the development sleeve 3 is set to 250 micrometers. When image formation of the development bias impressed to the development sleeve 3 was developed and carried out to the frequency of 1800Hz, and the alternating voltage of peak peak voltage 1200V as a thing on which the direct current voltage of -250V was made to superimpose, the good solid image of reflection density 1.3 was able to be obtained.

[0040] When image formation of 2000 more sheets was performed continuously, the good image without a sleeve ghost and a concentration fall was able to be obtained until the amount of charges of a toner also continued maintaining +15-+20microC/g and resulted in the last image.

[0041] Moreover, even if it performed 1000 image formation of a manuscript with a low image ratio continuously under the high-humidity environment, a good image without fogging is obtained and the

image in which the image formation of the continuation performed after leaving it several months after that does not have fogging at high concentration, either continued being obtained.

[0042] Example 2 drawing 3 is the cross section showing the condition at the time of un-developing negatives in the example 2 of the developer of this invention. In this example, it is the feature that scraping and the development sleeve 3 return the toner 8 which do not carry out inverse rotation of the elastic roller 15 which is the 1st developer supply means of a developer, and the inverse rotation of the toner delivery member 6 which is the 2nd developer supply means is made to carry out in the direction of arrow head f, and piles up in the A section in drawing near the contact section with the development sleeve 3 of the elastic blade 4 at the time of un-developing negatives to the container 2-way by the side of reverse by wing 6a of the delivery member 6. The same effect is acquired by this.

[0043] According to the above methods, since the toner 8 of the A section can be exchanged small quantity every, it is desirable, although it carries out when performing image formation under damp environment, and image formation of a manuscript with a high image ratio, when whenever

[condensation] used the toner which is not so expensive as a difference as a toner 8.

[0044] Example 3 drawing 4 is the cross section showing the condition at the time of un-developing negatives in the example 3 of the developer of this invention. In both this examples, inverse rotation of the 1st of a developer, the elastic roller 15 of the 2nd supply means, and the toner delivery member 6 is carried out at the time of un-developing negatives. While this prevents stagnation of the toner 8 to the A section near the elastic blade 4 contact section, churning of the toner 8 within the development container 2 and substitution of the about three development sleeve toner 8 can be promoted remarkably. It is effective by the case where the high toner of whenever [condensation] is used as a toner 8, and the time so that image formation under a high-humidity environment and image formation of a manuscript with a low image ratio may be performed.

[0045] Example 4 drawing 5 is the cross section showing the outline configuration of the example 4 of the developer of this invention. In this example, it is the big feature which make the seal member 7 prepared in the lower part of opening of the development container 2 serve as the charge grant member of a toner and antipole nature, **** the toner which is not developed on the development sleeve 3 by the seal member 7, and made it reduce the amount of electrifications. The same sign as the developer of the example 1 shown in drawing 1 except for the configuration of others of this example having installed only the elastic roller 15 as developer feed zone material in the development container 2 and the sign given [in / it is fundamentally the same and / drawing 5] to drawing 1 shows the same member.

[0046] A developer supplies a toner 8 to the development sleeve 3 by rotation of the elastic roller 15, conveys a toner 8 by rotation of the development sleeve 3, and regulates it in the contact section of the development sleeve 3 and a blade 4 on the way of [the / conveyance]. Fully carry out frictional electrification of the toner 8, and a toner thin layer is formed on the development sleeve 3. The toner which is not developed [which presented development with the toner 8 in a photo conductor 1 and the development section C which countered, and remained in development] is returned in the development container 2 by rotation of the development sleeve 3. It is as having mentioned above to supply the new toner 8 to the development sleeve 3, while stripping off from the development sleeve 3 with the elastic roller 15.

[0047] Similarly, it prevents that the toner 8 in a container 2 leaks out from the lower part of a container 2 while the seal member 7 energizes elastically, is contacted by the lower part of the development sleeve 2 and permits passage into the container 2 of the toner 8 which was not consumed in development by fixing the end to the lower part of the opening of the development container 2.

[0048] As described above, the toner which is not developed on the development sleeve 3 is ****(ed) by the seal member 7, and it is made to have reduced the amount of electrifications of the toner non-developed negatives rather than the amount of electrifications in the development section C in this example in the contact section B with the development sleeve 3 of the seal member 7. When it is got blocked, for example, frictional electrification polarity uses the toner of straight polarity as a toner 8, a toner and the frictional electrification charge of antipole nature, i.e., the quality of the material with electron-donative, are chosen as a material of the seal member 7, a minus charge is given by **** of the

toner by the seal member 7 in the contact section B non-developed negatives, and he neutralizes the plus charge of the toner non-developed negatives, and is trying to reduce the amount of electrifications.

[0049] When the toner of the diameter of a granule was used as a toner 8 in the case of the conventional developer shown by previous drawing 7, the following problems might arise under special conditions.

(1) the bottom of damp environment -- per manuscript with an extremely low image ratio -- many -- when continuation image formation of several sheets is performed, image concentration falls immediately.

(2) If a solid image is copied after the above-mentioned continuation image formation, the amount of development sleeve 1 round at the tip of an image which meets in the copy direction will arise [the sleeve ghost phenomenon in which concentration is thinner than the image portion after it].

[0050] It is thought that it was generated, as a result of checking that the amount of frictional electrification charges of the toner on the development sleeve 3 is quite high as compared with the time of image formation initiation, therefore the reflection force of a toner over the development sleeve 3 going up, and the toner on the development sleeve 3 with the fur brush roller 5 non-developed negatives stripping and fully not performing picking, when these causes are investigated. And it turned out that this phenomenon receives effect also in the quality of the material of the seal member 7 of the toner closure member which contacts the development sleeve 3 in the lower part of the opening of the development container 2. That is, by **** of the toner by it, depending on [amount / of electrifications / of the toner in the development section] the quality of the material of the seal member 7, the amount of electrifications of the toner non-developed negatives becomes high, consequently the toner with the fur brush roller 5 non-developed negatives strips off, and an effect gets worse further.

[0051] As described above, he is trying to reduce the amount of electrifications of the toner non-developed negatives rather than the amount of electrifications in the development section C at this example by **** of the toner which is not developed on the development sleeve 3 by the seal member 7 by choosing the material which can give the frictional electrification charge of the electrification polarity of a toner, and antipole nature as a seal member 7. Therefore, the reflection force over the development sleeve 3 of the toner non-developed negatives becomes small, the toner from the development sleeve 3 with the elastic roller 15 non-developed negatives strips, and picking becomes easy. for this reason, the bottom of damp environment -- per manuscript with an extremely low image ratio -- many -- concentration does not become thin rather than the image portion after it at a part for the development sleeve 1 round at the tip of an image which image concentration does not fall even if it performs continuation image formation of several sheets, a sleeve ghost does not occur even if it copies a solid image after continuation image formation further, and meets in the copy direction

[0052] the polarity of the toner after **** by the seal member 7 in the above-mentioned contact section B non-developed negatives is the polarity of a toner and like-pole nature in the development section C -- good -- it is better -- you may become reversed polarity by superfluous grant of the charge of antipole nature. However, the quality of the material of the seal member 7 must be chosen so that the absolute value of the amount of charges after **** in the contact section B may become smaller than the absolute value of the amount of charges in the development section C in that case. It is because the reflection force to the development sleeve 3 of a toner will not decrease if the absolute value of the amount of charges becomes large even when electrification of the toner after **** is reversed polarity, so it is based on the elastic roller 15, it strips off and effectiveness falls.

[0053] As the quality of the material of the seal member 7, various kinds of flexible sheets, such as PET, polyimide, a polyamide, urethane, and PVDF, can be used in consideration of frictional electrification nature with a toner. As for the contact pressure with the development sleeve 3 of the seal member 7, it is desirable to consider the balance which permits penetration into the container 2 from the development container 2 opening lower part of the toner on the development sleeve 3 non-developed negatives, and prevents leakage **** of the toner from a container 2, and to make it 5 - 50 g/cm. In this example, it considered as 10 g/cm.

[0054] The conditions of the development sleeve 3, the elastic blade 4, the elastic roller 15, and a toner 8 are as having mentioned above fundamentally. What set roughness Rz of the surface of an aluminum

sleeve with an outer diameter of 16mm to 1.5-3.0 micrometers as a development sleeve 3 is used like the time of an example 1. Contact pressure with the development sleeve 3 is made into 20 g/cm, using silicone rubber with a degree of hardness of 65 degrees as an elastic blade 4. The nonmagnetic toner which ** (ed) colloidal silica 1.5% outside was used for toner fine particles with a mean particle diameter of 12 micrometers which consists of the copolymer and pigment of styrene/acrylic resin, and styrene butadiene resins as a toner 8.

[0055] Moreover, as an elastic roller 15, contact width of face with the development sleeve 3 was similarly set to 3mm using what was twisted centering on urethane foam (density 0.025 g/cm³) with a thickness of 5mm. In order that the peripheral speed of the elastic roller 15 might raise the stripping force of the toner which is not developed on the development sleeve 3, when relative velocity with the development sleeve 3 in the contact section was carried out [second] in 5-600mm /, it was effective, and was made the same in 120mm/second by this example. In addition, the fur brush roller which transplanted hair can also use a rayon fiber etc. instead of the elastic roller 15 as toner feed zone material to the development sleeve 3.

[0056] When according to this example the above-mentioned toner 8 was supplied to the development sleeve 3 with the elastic roller 15, it regulated with the elastic blade 4 (silicone rubber, the degree of hardness of 65 degrees, contact pressure 20 g/cm) and the thin layer of a toner 8 was formed on the development sleeve 3, the toner thin layer of about 30-micrometer thickness was able to be formed in homogeneity. When the amount of electrifications of this toner thin layer was measured by the blowing off method, value with +20microC/g sufficient [the amount of charges] was acquired.

[0057] According to an example 1, a method given in JP,58-32375,B is desirable, development bias is impressed between a photo conductor 1 and the development sleeve 3, and the bias has the mutual voltage desirable [the method] which superimposed the direct current on the alternating current, although alternating voltage or direct current voltage is sufficient also as the developing-negatives method. Moreover, the development method may be a method which it is not restricted [method] to and contacts a developer thin layer to a photo conductor 1.

[0058] Next, the example of an experiment in this example is explained.

[0059] It includes in copying machine FC-2. the developer of example of experiment 1 this example -- the Canon, Inc. make -- The surface potential of the electrostatic latent image on the photo conductor 1 which consists of an organic photo conductor Umbra-540V, It is referred to as bright section-150V and the gap between a photo conductor 1 and the development sleeve 3 is set to 250 micrometers. Image formation of the development bias impressed to the development sleeve 3 was developed and carried out to the frequency of 1800Hz, and the alternating voltage of peak peak voltage 1200V as a thing on which the direct current voltage of -250V was made to superimpose.

[0060] The nonmagnetic toner which used styrene / acrylic resin as the principal component as a toner 8 was used, the silicone rubber blade was used as an elastic blade 4, and the nylon sheet was used as a seal member 7.

[0061] Consequently, the amount of electrifications of the toner on the development sleeve 3 became +5microC/g before the contact section of the elastic roller 15 by C after contact section B passage of +20micro C/g of development sections, and the seal member 7.

[0062] The nonmagnetic toner which used polyester system resin as the principal component as example of experiment 2 toner 8 is used. Use a polyurethane rubber blade as an elastic blade 4, and the sheet of a fluororesin system is used as a seal member 7. When negatives were developed like the above, the amount of electrifications of the toner on the development sleeve 3 became -5microC/g before the contact section of the elastic roller 15 by C after contact section B passage of -15micro C/g of development sections, and the seal member 7.

[0063] The nonmagnetic toner which used the styrene / acrylic resin of the example 1 of an experiment as the principal component as an example toner 8 of a comparison is used. The place which developed negatives, respectively, using the polyurethane rubber blade of the example 2 of an experiment, and the sheet of a fluororesin system as the elastic blade 4 and a seal member 7, The amount of electrifications of the toner on the development sleeve 3 became +30microC/g before the contact section of the elastic

roller 15 by C after contact section B passage of +20micro C/g of development sections, and the seal member 7.

[0064] In any [of the above-mentioned examples 1-2 of an experiment, and the example of a comparison] case, the 1000-sheet continuation copy of the manuscript of a low image ratio was carried out under damp environment. Consequently, in the examples 1 and 2 of an experiment, even if it could maintain the good image of reflection density 1.3 and copied the solid image after that until it resulted in the last image, the ghost image was not generated. On the other hand, in the case of the example of a comparison, reflection density fell to 0.9 from 1.3 by about 100 sheets, and the ghost also generated the solid image.

[0065] Example 5 drawing 6 is the cross section showing the outline configuration of the example 5 of the developer of this invention. In this example, the electrification equipment 18 of arbitration has been arranged between the seal member 7 of the opening lower part of the development container 2, and the pars basilaris ossis occipitalis of a container 2, the polar bias which neutralizes the charge of the toner on the development sleeve 3 non-developed negatives to the seal member 7 was impressed, and the seal member 7 was used as the charge grant member of a toner and antipole nature.

[0066] The same effect as an example 4 is acquired also by such method. Furthermore, in order to use the seal member 7 as a charge grant member, it is not required to choose the quality of the material of the seal member 7 according to the polarity of a toner, and there is also an advantage easily applicable to the toner of positive and negative amphipathy only by changing the polarity of the bias impressed with electrification equipment 18.

[0067] In this operation, the nonmagnetic toner of styrene / acrylic resin was used as a toner 8, the silicone rubber blade was used as an elastic blade 4, the PET sheet was used as a seal member 7, on the conditions which impressed the bias of minus to the seal member 7 from electrification equipment 18, negatives were developed and image formation was performed. When the amount of electrifications of the toner on the development sleeve 3 non-developed negatives was made into +5microC/g before the contact section of the elastic roller 15 by C after passage of the contact section B of +20micro C/g of development sections, and the seal member 7, the good image has been continuously copied also under damp environment.

[0068] In a six examples example, it is the feature to have prepared the conductive elastic layer which distributed carbon etc. in the contact-to development sleeve 3 of seal member 7 side instead of choosing the material of the seal member 7 to a toner 8 in the example 4 explained with reference to drawing 5.

[0069] According to this, since the electrification charge of the toner on a part for the voltage drop by resistance of the elastic layer of the seal member 7 and the development sleeve 3 non-developed negatives escapes to an elastic layer side, the effect same with having used seal member 7 the very thing as the charge grant member of a toner and antipole nature is acquired, like the time of being an example 4, the amount of electrifications of the toner non-developed negatives is reduced rather than the amount of electrifications in the development section C, and things can do it.

[0070] In this example, when what carried out about 30 partial powder of the carbon black into the urethane rubber sheet with a thickness of 200 micrometers as a seal member 7 was used, the amount of electrifications of the toner on the development sleeve 3 non-developed negatives fell to +10microC/g before the contact section of the elastic roller 15 by C after passage of the contact section B of +20micro C/g of development sections, and the seal member 7.

[0071]

[Effect of the Invention] As explained above, in the developer of this invention The 1st developer feed zone material which newly supplies the toner in a development container while rotating in the present developer support and this direction at the time of development and stripping off the toner as a 1 component developer which is not developed on developer support, Or both [which supply the toner in a development container in the direction of the 1st developer feed zone material by rotating / one side or] [the] [both / of developer feed zone material] Since it was made to rotate to hard flow with the time of development in between [until it ends image formation actuation / one / at least] after ending development actuation after starting the image formation actuation at the time of un-developing

negatives until it started development actuation or Even if it prevents, and leaves equipment for a long period of time or continues using it for the copy of the manuscript of a low image ratio under a high-humidity environment, that a toner condenses near the contact section with the developer support of elastic specification-part material It prevents that the excess of the amount of supply of the toner near the elastic specification-part material arises, and the solid image of high concentration and extensive area can be reproduced faithfully, without producing nonuniformity and fogging.

[0072] Moreover, it sets to the developer with which only the 1st above-mentioned feed zone material was installed as developer feed zone material, and the seal member which closes the toner in a development container in contact with developer support was installed in other modes of this invention. A seal member is made to serve as the duty as a charge grant member which gives the frictional electrification charge of the frictional electrification polarity and antipole nature to the toner on developer support non-developed negatives by choosing the material of a seal member to a toner etc. Since it has arranged between the contact sections of the development section and the developer support of developer feed zone material Even if can reduce the amount of electrifications of the toner non-developed negatives, it can strip off easily by the above-mentioned development feed zone material, it uses the diameter toner of a granule under damp environment and it carries out image formation of the manuscript of a low image ratio continuously, the solid image of high concentration and extensive area is reproducible.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the cross section showing the outline configuration of the example 1 of the developer of this invention.

[Drawing 2] It is the cross section showing the condition at the time of un-developing [of the developer of drawing 1] negatives.

[Drawing 3] It is the cross section showing the condition at the time of un-developing negatives in the example 2 of the developer of this invention.

[Drawing 4] It is the cross section showing the condition at the time of un-developing negatives in the example 3 of the developer of this invention.

[Drawing 5] It is the cross section showing the outline configuration of the example 4 of the developer of this invention.

[Drawing 6] It is the cross section showing the outline configuration of the example 5 of the developer of this invention.

[Drawing 7] It is the cross section showing the outline configuration of an example of the conventional developer.

[Drawing 8] It is the cross section showing the outline configuration of other examples of the conventional developer.

[Description of Notations]

- 1 Photo Conductor
- 2 Development Container
- 3 Development Sleeve
- 4 Elastic Blade
- 5 Fur Brush Roller
- 6 Toner Delivery Member
- 7 Seal Member
- 8 Toner
- 15 Elastic Roller
- 18 Electrification Equipment

[Translation done.]

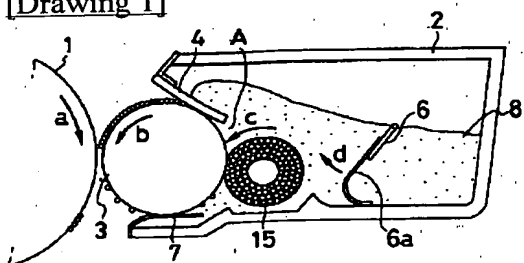
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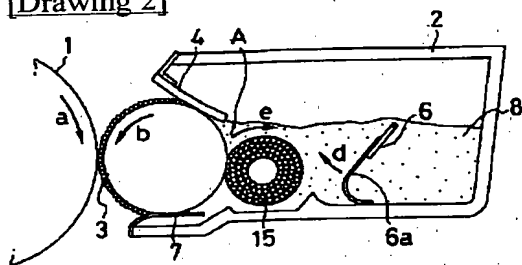
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DRAWINGS

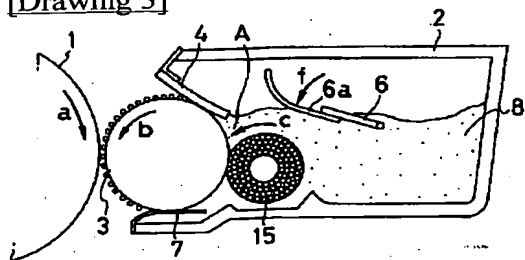
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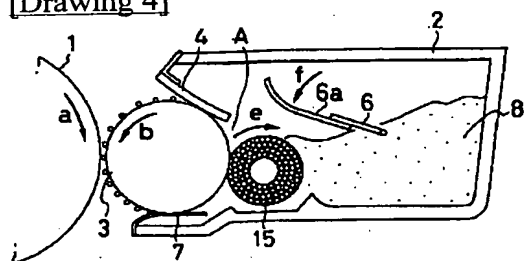
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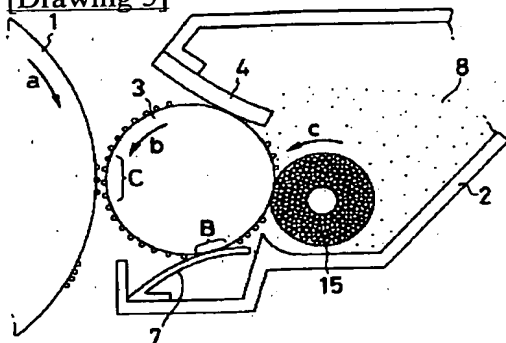
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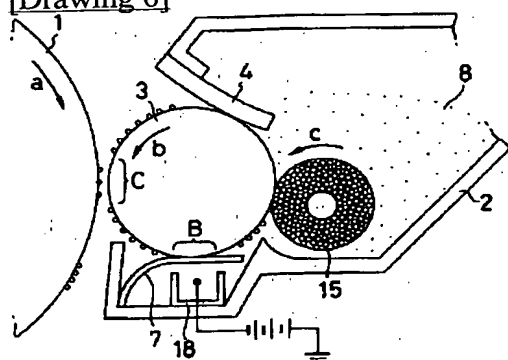
[Drawing 4]



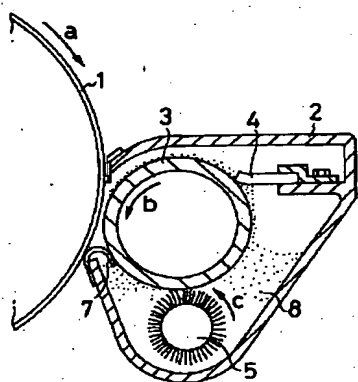
[Drawing 5]



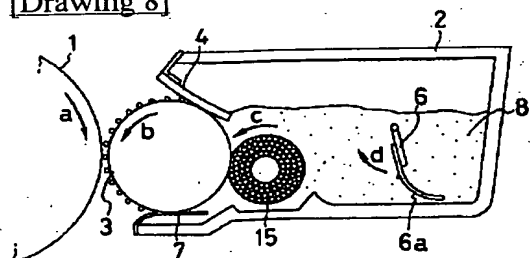
[Drawing 6]



[Drawing 7]



[Drawing 8]



[Translation done.]

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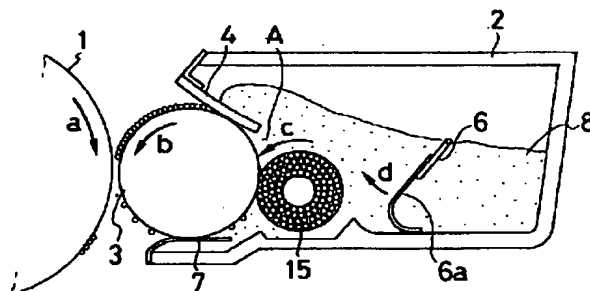
(54)【発明の名称】 現像装置

(57)【要約】

【目的】 一成分現像剤のトナーが弾性規制部材の現像剤担持体との当接部の近傍に凝集するのを防止し、且つ現像装置を高湿環境下で長期間放置したり、低画像比率の原稿の複写に使用し続けても、弾性規制部材の近傍へのトナーの供給量過多が生じるのを防止して、高濃度、広面積のベタ画像をムラやカブリを生じることなく忠実に再現できるようにすることである。

【構成】 現像スリーブ3と同方向に回転してスリーブ3上の未現像トナーを剥ぎ取り且つ新たなトナー8を供給する弾性ローラ15、又はローラ15と逆方向に回転して現像容器2内トナー8をローラ15方向に供給するトナー送り部材6の一方又は両方を、非現像時に現像時と逆回転させた。

【効果】 非現像時のローラ15又は送り部材6の一方又は両方の逆回転により、弾性ブレード4のスリーブ3との当接部の近傍へのトナーの滞留防止等が図られ、目的を達成することができる。



(2)

特開平5-297696

1

2

【特許請求の範囲】

【請求項1】 一成分現像剤を収容した現像容器内に、現像剤を担持して回転することにより像担持体と対向した現像部へ搬送する現像剤担持体と、現像剤担持体上に担持された現像剤の量を現像剤担持体に当接して規制する弾性規制部材と、現像剤担持体とその回転方向上流側で当接して同方向に回転することにより、現像部での現像によって残った未現像の現像剤を現像剤担持体から剥ぎ取ると共に新たな現像剤を供給する第1の現像剤供給部材と、現像容器内の現像剤を回転することにより第1の現像剤供給部材方向に供給する第2の現像剤供給部材とを備えた現像装置において、前記第1、第2の現像剤供給部材のうちの一方又は両方を、画像形成動作を開始したのち現像動作を開始するまでの間又は現像動作を終了したのち画像形成動作を終了するまでの間の少なくとも一方の間に逆回転させることを特徴とする現像装置。

【請求項2】 一成分現像剤を収容した現像容器内に、現像剤を担持して回転することにより像担持体と対向した現像部へ搬送する現像剤担持体と、現像剤担持体上に担持された現像剤の量を現像剤担持体に当接して規制する弾性規制部材と、現像剤担持体とその回転方向上流側で当接して同方向に回転することにより、現像部での現像によって残った未現像の現像剤を現像剤担持体から剥ぎ取ると共に新たな現像剤を供給する現像剤供給部材と、現像剤担持体に当接して現像容器内の現像剤を封止する封止部材とを備えた現像装置において、前記封止部材に、現像剤担持体上の未現像の現像剤に対してその摩擦帯電極性と反対極性の摩擦帯電電荷を付与する電荷付与部材を兼ねさせ、その封止部材を前記現像部と現像剤供給部材の当接部との間に設置したことを特徴とする現像装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、複写装置、画像表示装置、画像記録装置、プリンタ或いはファクシミリ等において、電子写真感光体や静電記録電体などからなる像担持体上に形成した潜像を現像して可視化するのに使用する現像装置に関し、特に一成分現像剤を用いて現像する現像装置に関する。

【0002】

【従来の技術】複写装置や画像表示装置、画像記録装置、プリンタ、ファクシミリ等の画像形成装置においては、電子写真感光体や静電記録電体などからなる像担持体上に形成した潜像を、現像装置により現像してトナー像として可視化することを行なっている。

【0003】このような現像装置の一つとして、乾式一成分現像装置が種々提案され又実用化されている。しかし、いずれの現像装置でも、現像剤担持体上に一成分現像剤のトナーの薄層を形成することが極めて難しい。然るに、画像の鮮明度、解像度等の向上が求められている

現在、トナーの薄層形成法及びその装置に関する開発は必須となっており、これに応えていくつかの方策が提案されている。

【0004】例えば特開昭54-43038では、ゴム若しくは金属の弾性ブレードを現像スリーブに軽圧接触させ、現像スリーブ上に担持したトナーを上記の接触部のニップ部を通過させて規制することにより、現像スリーブ上にトナーの薄層を形成し、且つそこでの摩擦によりトナーに十分な摩擦帯電電荷量を与えるものである。

【0005】又弾性ブレードで非磁性トナーの規制を行なう場合、別途トナー供給部材が必要となる。これは、磁性トナーでは現像スリーブ内の磁石の磁力により現像スリーブ上にトナーを供給することができるが、非磁性トナーではそれができないのでメカニク的なトナー供給部材を必要とするのである。

【0006】そこで、本出願人は、図7に示す現像装置を提案した（特開昭58-116559）。この提案の現像装置では、非磁性トナー8を収容した現像容器2内に、弾性ブレード4よりも現像スリーブ3の回転方向上流側の位置で現像スリーブ3に当接するファープラシ構造のローラ5を配設して、ローラ5で現像スリーブ3上の未現像のトナー8の剥取り及び現像スリーブ3上への新たなトナー8の供給を行なわせている。

【0007】これによれば、トナー8が非磁性トナーの場合にも、現像スリーブ3上にトナー8の薄層を良好に形成して感光ドラム1上の静電潜像を現像することができ、現像により高濃度、広面積のベタ黒画像を忠実に再現して、スリーブゴーストのない画像を常に安定して得ることが可能となった。又現像装置の簡略化を図ることが可能となった。

【0008】

【発明が解決しようとする課題】ところで、近年、現像装置自体の小型化、或いは複数個の現像装置をコンパクトに収納して複数色の画像を形成する複写装置などが要求され、図8に示すような横形配置の現像装置が要望されている。

【0009】このような現像装置の第1の現像剤供給手段である弾性ローラ15は、同じ回転数でも現像スリーブ3上へのトナー8の供給を十分に行なえ且つ未現像トナーの剥ぎ取りも確実に行なえるように、回転方向を矢印c方向にして現像スリーブ3との相対速度を大きくしている。又第2の現像剤供給手段であるトナー送り部材6も、同様な理由で矢印d方向に回転させている。

【0010】上記のようにすることにより、横形配置の現像装置においても高濃度、広面積のベタ画像を忠実に再現できるようになったが、ある特定の条件下では以下のような問題点を生じた。

(1) 上記の横形配置の現像装置では、複写動作のクイックスタートを目的として低温定着用のトナーを使用した場合、従来トナーと比較して凝集度が高いため、弾性

(3)

特開平5-297696

3

ブレード4の当接部近傍でトナーのブロッキングが生じ、ムラやカブリの大きい画像が生じる場合があった。

(2) 横形配置の現像装置では、高温環境下に長期間放置したり、高温環境下で画像比率の低い原稿を複写し続けると、現像に要するトナー量に比べて弾性ブレード4近傍へのトナー供給量が過多となり、上記(1)と同様な現象が生じた。

【0011】本発明の目的は、一成分現像剤のトナーが弾性規制部材の現像剤担持体との当接部の近傍に凝集するのを防止し、且つ装置を高温環境下で長期間放置したり、低画像比率の原稿の複写に使用し続けても、弾性規制部材の近傍へのトナーの供給量過多を生じるのを防止して、高濃度、広面積のベタ画像をムラやカブリを生じることなく忠実に再現できるようにした現像装置を提供することである。

【0012】

【課題を解決するための手段】上記目的は本発明に係る現像装置にて達成される。要約すれば本発明は、一成分現像剤を収容した現像容器内に、現像剤を担持して回転することにより像担持体と対向した現像部へ搬送する現像剤担持体と、現像剤担持体上に担持された現像剤の量を現像剤担持体に当接して規制する弾性規制部材と、現像剤担持体とその回転方向上流側で当接して同方向に回転することにより、現像部での現像によって残った未現像の現像剤を現像剤担持体から剥ぎ取ると共に新たな現像剤を供給する第1の現像剤供給部材と、現像容器内の現像剤を回転することにより第1の現像剤供給部材方向に供給する第2の現像剤供給部材とを備えた現像装置において、前記第1、第2の現像剤供給部材のうち的一方又は両方を、画像形成動作を開始したのち現像動作を開始するまでの間又は現像動作を終了したのち画像形成動作を終了するまでの間の少なくとも一方の間に逆回転させることを特徴とする現像装置である。

【0013】又本発明は、一成分現像剤を収容した現像容器内に、現像剤を担持して回転することにより像担持体と対向した現像部へ搬送する現像剤担持体と、現像剤担持体上に担持された現像剤の量を現像剤担持体に当接して規制する弾性規制部材と、現像剤担持体とその回転方向上流側で当接して同方向に回転することにより、現像部での現像によって残った未現像の現像剤を現像剤担持体から剥ぎ取ると共に新たな現像剤を供給する現像剤供給部材と、現像剤担持体に当接して現像容器内の現像剤を封止する封止部材とを備えた現像装置において、前記封止部材に、現像剤担持体上の未現像の現像剤に対してその摩擦帯電極性と反対極性の摩擦帯電電荷を付与する電荷付与部材を兼ねさせ、その封止部材を前記現像部と現像剤供給部材の当接部との間に設置したことを特徴とする現像装置である。

【0014】

【実施例】

4

実施例1

図1は、本発明の現像装置の実施例1の概略構成を示す断面図である。図1の現像装置は、現像動作時の状態を表している。

【0015】本現像装置は、図中矢印a方向に回転する像担持体としての感光体1上の静電潜像を現像するものである。感光体1は、例えばカルソンプロセスにより静電潜像を形成する所謂ゼログラフ感光体、特公昭42-23910公報に記載の表面に絶縁層を有したNPプロセスにより静電潜像を形成する感光体、静電記録法により潜像を形成する絶縁体、転写法により静電潜像を転写、形成する絶縁体、その他適宜の方法により静電潜像(若しくは電位潜像)或いは磁気潜像を形成、保持できる部材である。

【0016】本実施例の現像装置は、図1に示すように、一成分現像剤として非磁性トナー8を収容した現像容器2内に、現像剤担持体としての現像スリーブ3、現像剤規制部材としての弾性ブレード4、第1の現像剤供給手段としての弾性ローラ15及び第2の現像剤供給手段としてのトナー送り部材6を備えている。

【0017】現像容器2は、感光体1と対面した箇所に現像装置の長手方向(紙面に垂直な方向)に延在する開口部を有し、その開口部に上記の現像スリーブ3が、図で見ても右半周面を容器2内に突入し、左半周面を容器2外から露出して感光体1に僅少な間隙を開けて臨むようにして、回転自在に設置されている。現像スリーブ3は、アルミニウム等の非磁性材料からなり、矢印b方向へ回転駆動されようになっている。

【0018】弾性ブレード4は、現像容器2の現像スリーブ3の略頂部の位置に設けられ、現像スリーブ3の回転方向下流側に傾いてその周面に回転方向と対向するように当接されている。弾性ローラ15は、現像スリーブ3の周面に当接し且つ矢印c方向に回転可能なように支持され、その当接部はブレード4の現像スリーブとの当接部よりも現像スリーブ3の回転方向上流側に位置されている。

【0019】トナー送り部材6は、先端に可撓性シートの羽根6aを設けた回転部材からなっており、矢印d方向に回転される。

【0020】現像容器2の開口部の下部には、容器2からのトナー8の漏れ出しを防ぐシール部材7が設置されている。シール部材7は、その一端を容器2の開口部の下部に固定することによって弾性的に付勢して、現像スリーブ2の下部に当接されている。

【0021】本実施例の現像装置の動作について説明する。現像動作中、弾性ローラ15の回転により現像容器2内のトナー8が現像スリーブ3に供給され、そのトナー8は現像スリーブ3の回転により搬送されて、現像スリーブ3とブレード4との当接部に侵入し、当接部を通過する際に現像スリーブ3とブレード4の両方によって

(4)

特開平5-297696

5

6

摺擦され、十分な摩擦帯電電荷を付与され、又ブレード4による規制によって現像スリーブ3上に薄層状のトナー層に形成される。このようにしてトナー8は、上記の当接部で帯電及び規制を受けた後そこを抜け出して、現像スリーブ3の回転に伴い感光体1と対向する現像部へ運ばれる。

【0022】現像部において、現像スリーブ3上のトナー8は、一部が現像動作により消費され、トナー8の残りは現像スリーブ3の回転により下部から現像容器2内に入って戻される。現像容器2開口部の下部のシール部材7は、現像で消費されなかったトナー8の現像容器2内への通過を許容すると共に、現像容器2内のトナー8が容器2の下部から漏出するのを防止する。

【0023】上記の現像容器2内に戻されたトナー8は、弾性ローラ15によって現像スリーブ3との当接部で現像スリーブ3から剥取られる。同時に弾性ローラ15の回転により現像スリーブ3上に現像容器2内の新たなトナー8が供給され、新たなトナー8は、再び現像スリーブ3の回転に伴ない、現像スリーブ3と弾性ブレード14との当接部へ搬送される。

【0024】一方、上記の剥取られたトナー8の大部分は、弾性ローラ15の回転に伴ない現像容器2内のトナー8中に搬送されて混ざり合い、剥取られたトナー8の帯電電荷が分散される。

【0025】以上のようにして、現像スリーブ3上のトナー8は弾性ローラ15の回転によって入れ替わりを生じるが、従来の箇所で述べたように、特定条件下ではブレード4の現像スリーブ3との当接部近傍の、ブレード4と現像スリーブ3と弾性ローラ15に囲まれた空間（図中Aで示す領域）にトナー8が凝集（ブロッキング）してしまうことがある。

【0026】そこで本実施例では、非現像時、即ち画像形成動作を開始したのち現像動作を開始するまでの間又は現像動作を終了したのち画像形成動作を終了するまでの間の少なくとも一方の間に、図2に示すように、弾性ローラ15を現像時とは逆方向に矢印e方向に回転させるものである。

【0027】このような弾性ローラ15の逆回転によれば、図中A部に溜っていた過剰のトナーが第2供給手段のトナー送り部材6方向に完全に戻されるので、容器2内トナー8と十分に混ざり合い、A部にトナーの凝集が発生しない。又現像装置を高湿環境下で長期間放置したり、低画像比率の原稿の複写に使用し続けても、弾性ブレード4の近傍にトナー8が過剰に供給されることがない。従って高濃度、広面積のベタ画像をムラやカブリを生じることなく忠実に再現できる。

【0028】上記において、弾性ローラ15を現像動作中においても矢印e方向に回転させれば、常にA部へのトナーの詰まりを生じず、画像比率の低い原稿であれば十分な濃度を確保できるが、広面積のベタ黒画像などの

追従性が悪化してしまった。本実施例においては、非現像時のみ逆回転するため、ベタ黒追従性が悪化することがなく、良好な画像を得ることができる。

【0029】この弾性ローラ15の逆回転は、複写動作に対して応答性がよければいかなる方法で行なってもよい。例えば現像時は現像スリーブ3の駆動ギヤと弾性ローラ15の駆動ギヤの間を1つのギヤを介して連結し、現像動作終了後、装置停止まではそのギヤが外れ、現像スリーブ3のギヤと弾性ローラ15のギヤが直接連結して逆回転するような構成にすればよい。

【0030】第1供給手段である弾性ローラ15としては、発泡度の比較的低い骨格構造状のスポンジローラが好ましい。本実施例では、肉厚5mmのウレタン発泡体（密度0.025g/cm³）を心棒に巻き付けたものを用いた。このスポンジローラからなる弾性ローラ15は、現像スリーブ3にソフトに当接するが、その当接幅としては1~10mmが有効で、本実施例では3mmとした。

【0031】又現像時の弾性ローラ15の周速は、現像スリーブ3上の未現像のトナーの剥取り力を向上させるために、当接部においての現像スリーブ3との相対速度を5~600mm/秒にすると有効である。本実施例では120mm/秒とした。逆回転時は、現像時のA部に溜るトナーを送り部材6側へ戻せればよく、弾性ローラ15の当接部におけるスリーブ周速との相対速度は、絶対値で0~100mm/秒が有効で、本実施例では40mm/秒とした。

【0032】弾性ローラ15の部材としてはレーヨン繊維などを植毛したファープラシ構造のものでもよく、同様の効果が得られる。

【0033】第2供給手段のトナー送り部材6の羽根6aは、PET、ウレタン、ポリイミド等の可撓性シートで構成され、厚みとしては15~75μm、自由長としては図のA部に届く位の長さを有したものが有効である。本実施例においては、羽根6aは厚み38μmのPETフィルムを用いた。

【0034】現像スリーブ3としては、SUS、Alなどの金属及び各種樹脂、ゴムなどの円筒体或いはベルト体を用い、トナー搬送性を向上させるために、表面のR_zを0.5~5.0μmに粗面化処理したものが有効である。本実施例では外径16mmのアルミニウムスリーブの表面上に#600の定型ビーズでブラスト処理して、表面の粗度R_zを1.5~3.0μmにしたものを用いた。

【0035】弾性ブレード4としては、例えばJIS硬度40~80°のウレタン、シリコン、フッ素、クロロブレン又は金属分散ゴムなどの各種ゴムが使用でき、好ましくは硬度50~70°のものが現像剤薄層の安定な形成のためによい。本実施例では弾性ブレードに硬度65°のシリコンゴムを用いた。

(5)

特開平5-297696

7

【0036】この弾性ブレード4は、その端部が現像スリーブ3に当接するように付勢される。ブレード4の端部とは、ブレード4の先端又はその近傍又は先端及びその近傍のいずれでもよい。弾性ブレード4の現像スリーブ3との当接圧は、 $5 \sim 200 \text{ g/cm}$ (スリーブ母線方向の線圧) が有効で、本実施例では 20 g/cm とした。

【0037】本実施例では、トナー8として非磁性トナーを用い、具体的には、スチレン/アクリル樹脂とスチレン・ブタジエン樹脂の共重合体及び顔料からなる平均粒径 $12 \mu\text{m}$ のトナー粉体に、コロイダルシリカ 1.5% を外添したトナーを用いた。これを弾性ローラ15により現像スリーブ3に供給し、弾性ブレード4により規制して、現像スリーブ3上にトナー8の薄層を形成したところ、約 $30 \mu\text{m}$ 厚のトナー薄層を均一に形成することができた。このトナー薄層の帯電量をブローオフ法で測定したところ、電荷量は $+15 \mu\text{C/g}$ であり、十分な値が得られた。

【0038】ここで使用する現像方法としては、特公昭58-32375号に記載の方法が好ましい。感光体1と現像スリーブ3との間には現像バイアスが印加され、バイアスとしては交流電圧でも直流電圧でもよいが、交流に直流を重ねた交互電圧が好ましい。現像方法はこれに限られるものではなく、現像剤薄層を感光体1に接触させる方式であってもよい。

【0039】以上の構成の本実施例の現像装置をキヤノン(株)製複写機FC-2に組み込んで、有機光導電体からなる感光体1上の静電潜像の表面電位を暗部 -540 V 、明部 -150 V とし、感光体1と現像スリーブ3との間の間隙を $250 \mu\text{m}$ とし、現像スリーブ3に印加する現像バイアスを周波数 1800 Hz 、ピーク・ピーク電圧 1200 V の交流電圧に -250 V の直流電圧を重ねさせたものとして、現像を行なって画像形成したところ、反射濃度1.3の良好なベタ画像を得ることができた。

【0040】更に2000枚の画像形成を連続的に行なったところ、トナーの電荷量も $+15 \sim +20 \mu\text{C/g}$ を維持し続け、最終の画像に至るまでスリーブゴースト及び濃度低下のない良好な画像を得ることができた。

【0041】又高温環境下で画像比率の低い原稿の画像形成を1000枚連続して行なっても、カブリのない良好な画像が得られ、その後に数カ月放置してから行なった連続の画像形成でも、高濃度でカブリのない画像が得られ続けた。

【0042】実施例2

図3は、本発明の現像装置の実施例2における非現像時の状態を示す断面図である。本実施例では、非現像時に、現像装置の第1の現像剤供給手段である弾性ローラ15は逆回転させず、第2の現像剤供給手段であるトナー送り部材6を矢印f方向に逆回転させ、弾性ブレード

8

4の現像スリーブ3との当接部近傍の図中のA部に滞留するトナー8を送り部材6の羽根6aで掻き取り、現像スリーブ3とは逆側の容器2方向に戻すことが特徴である。これによっても同様な効果が得られる。

【0043】以上のような方法によれば、A部のトナー8を少量ずつ取り換えることができるので、トナー8として凝集度が差程高くないトナーを用いた場合や、低温環境下での画像形成、画像比率の高い原稿の画像形成を行なうようなときに実施するのに好ましい。

【0044】実施例3

図4は、本発明の現像装置の実施例3における非現像時の状態を示す断面図である。本実施例では、非現像時に、現像装置の第1、第2の供給手段の弾性ローラ15、トナー送り部材6を共に逆回転させるものである。これにより弾性ブレード4当接部近傍のA部へのトナー8の滞留を防止すると共に、現像容器2内でのトナー8の攪拌及び現像スリーブ3近傍でのトナー8の入れ換わりを著しく促進することができる。トナー8として凝集度の高いトナーを用いた場合や、高温環境下での画像形成、画像比率の低い原稿の画像形成を行なうようなときにより効果的である。

【0045】実施例4

図5は、本発明の現像装置の実施例4の概略構成を示す断面図である。本実施例では、現像容器2の開口部の下部に設けられたシール部材7にトナーと反対極性の電荷付与部材を兼ねさせて、シール部材7により現像スリーブ3上の未現像のトナーを摺擦して、その帯電量を低下させるようにしたことが大きな特徴である。本実施例のその他の構成は、現像容器2内に現像剤供給部材として弾性ローラ15のみを設置したことを除き、図1に示した実施例1の現像装置と基本的に同じで、図5において図1に付した符号と同一の符号は同一の部材を示す。

【0046】現像装置は、弾性ローラ15の回転でトナー8を現像スリーブ3に供給し、現像スリーブ3の回転でトナー8を搬送し、その搬送途上で現像スリーブ3とブレード4の当接部で規制して、トナー8を十分に摩擦帯電し且つ現像スリーブ3上にトナー薄層を形成し、そのトナー8を感光体1と対向した現像部Cで現像に供し、現像で残った未現像のトナーを現像スリーブ3の回転により現像容器2内に戻し、弾性ローラ15で現像スリーブ3上から剥ぎ取ると共に現像スリーブ3に新たなトナー8を供給することは、前述した通りである。

【0047】シール部材7は、同様に、その一端を現像容器2の開口部の下部に固定することによって弾性的に付勢して、現像スリーブ2の下部に当接されており、現像で消費されなかったトナー8の容器2内への通過を許容すると共に、容器2内のトナー8が容器2の下部から漏出するのを防止する。

【0048】本実施例では、上記したように、シール部材7の現像スリーブ3との当接部Bにおいて、シール部

(6)

特開平5-297696

9

10

材7で現像スリーブ3上の未現像のトナーを摺擦して、未現像のトナーの帯電量を現像部Cでの帯電量よりも低下させるようにしてある。つまり、例えばトナー8として摩擦帯電極性が正極性のトナーを用いる場合、シール部材7の材料として、トナーと反対極性の摩擦帯電電荷、即ち電子供与性のある材質を選択して、当接部Bでのシール部材7による未現像トナーの摺擦でマイナス電荷を付与し、未現像トナーのプラス電荷を中和して帯電量を低減するようにしているのである。

【0049】先の図7で示した従来の現像装置の場合、トナー8として小粒径のトナーを使用したときに、特別な条件下では次のような問題が生じることがあった。

(1) 低温環境下で極端に画像比率の低い原稿につき多数枚の連続画像形成を行なったところ、画像濃度がすぐに低下する。

(2) 上記の連続画像形成の後ベタ画像を複写すると、複写方向に沿う画像先端の現像スリーブ1周分がそれよりも後の画像部分よりも濃度が薄いスリーブゴースト現象が生じる。

【0050】これらの原因を調べたところ、現像スリーブ3上のトナーの摩擦帯電電荷量が画像形成開始時に比較してかなり高いことが確認され、そのために現像スリーブ3に対するトナーの鏡映力が上昇して、ファークラシローラ5による現像スリーブ3上の未現像トナーの剥ぎ取りが十分に行なわれない結果、生じたものと考えられる。そしてこの現象は、現像容器2の開口部の下部で現像スリーブ3に当接するトナー封止部材のシール部材7の材質にも影響を受けることが分った。つまりシール部材7の材質によってはそれによるトナーの摺擦により、現像部におけるトナーの帯電量よりも未現像トナーの帯電量が高くなり、その結果、ファークラシローラ5による未現像トナーの剥ぎ取り効果が更に悪化するのである。

【0051】本実施例では、上記したように、シール部材7としてトナーの帯電極性と反対極性の摩擦帯電電荷を付与することができる材料を選択することにより、シール部材7による現像スリーブ3上の未現像のトナーの摺擦で、未現像のトナーの帯電量を現像部Cでの帯電量よりも低下させるようにしている。従って未現像トナーの現像スリーブ3に対する鏡映力が小さくなり、弾性ローラ15による現像スリーブ3上からの未現像トナーの剥ぎ取りが容易になる。このため低温環境下で極端に画像比率の低い原稿につき多数枚の連続画像形成を行なっても、画像濃度が低下することがなく、更に連続画像形成の後ベタ画像を複写してもスリーブゴーストが発生することがなく、複写方向に沿う画像先端の現像スリーブ1周分にそれよりも後の画像部分よりも濃度が薄くなることがない。

【0052】上記の当接部Bでのシール部材7による摺擦後の未現像トナーの極性は、現像部Cにおけるトナー

の極性と同極性であることが好ましが、反対極性の電荷の過剰付与により逆極性になってもよい。しかしその場合は、当接部Bでの摺擦後の電荷量の絶対値が現像部Cでの電荷量の絶対値よりも小さくなるように、シール部材7の材質を選択しなければならない。摺擦後のトナーの帯電が逆極性の場合でも、その電荷量の絶対値が大きくなればトナーの現像スリーブ3への鏡映力が低減しないので、弾性ローラ15による剥ぎ取り効率が低下するからである。

【0053】シール部材7の材質としては、トナーとの摩擦帯電性を考慮してPET、ポリイミド、ポリアミド、ウレタン、PVDFなど各種の可撓性シートを用いることができる。シール部材7の現像スリーブ3との当接圧は、現像スリーブ3上の未現像トナーの現像容器2開口部下部からの容器2内への進入を許容し且つ容器2からのトナーの漏れ出しを防止するバランスを考慮して、5～50g/cmにすることが好ましい。本実施例では10g/cmとした。

【0054】現像スリーブ3、弾性ブレード4、弾性ローラ15及びトナー8の条件は基本的には前述した通りで、実施例1のときと同様、現像スリーブ3としては外径16mmのアルミニウムスリーブの表面の粗度R_zを1.5～3.0μmにしたものを用い、弾性ブレード4としては硬度65°のシリコンゴムを用い、その現像スリーブ3との当接圧は20g/cmとし、トナー8としてスチレン/アクリル樹脂とスチレン・ブタジエン樹脂の共重合体及び顔料からなる平均粒径12μmのトナー粉体に、コロイダルシリカ1.5%を外添した非磁性トナーを用いた。

【0055】又弾性ローラ15としては同様に、肉厚5mmのウレタン発泡体(密度0.025g/cm³)を心棒に巻き付けたものを用い、その現像スリーブ3との当接幅は3mmとした。弾性ローラ15の周速は同様に、現像スリーブ3上の未現像のトナーの剥取り力を向上させるために、当接部においての現像スリーブ3との相対速度を5～600mm/秒にすると有効で、本実施例では120mm/秒とした。尚、現像スリーブ3へのトナー供給部材として弾性ローラ15の代わりに、レーヨン繊維などを植毛したファークラシローラも使用することができる。

【0056】本実施例によれば、上記のトナー8を弾性ローラ15により現像スリーブ3に供給し、弾性ブレード4(シリコンゴム、硬度65°、当接圧20g/cm)により規制して、現像スリーブ3上にトナー8の薄層を形成したところ、約30μm厚のトナー薄層を均一に形成することができた。このトナー薄層の帯電量をブローオフ法で測定したところ、電荷量は+20μC/gの十分な値が得られた。

【0057】現像法も実施例1に準じ、特公昭58-32375号に記載の方法が好ましく、感光体1と現像ス

(7)

特開平5-297696

11

リーブ3との間には現像バイアスが印加され、そのバイアスは交流電圧でも直流電圧でもよいが、交流に直流を重ねた交互電圧が好ましい。又現像方法はこれに限られるものではなく、現像剤薄層を感光体1に接触させる方式であってもよい。

【0058】次に本実施例における実験例について説明する。

【0059】実験例1

本実施例の現像装置をキャノン（株）製複写機FC-2に組み込んで、有機光導電体からなる感光体1上の静電潜像の表面電位を暗部-540V、明部-150Vとし、感光体1と現像スリーブ3との間の間隙を250 μ mとし、現像スリーブ3に印加する現像バイアスを周波数1800Hz、ピーク・ピーク電圧1200Vの交流電圧に-250Vの直流電圧を重ねさせたものとして、現像を行なって画像形成した。

【0060】トナー8としてはスチレン／アクリル系樹脂を主成分とした非磁性トナーを使用し、弾性ブレード4としてシリコンゴムブレードを使用し、シール部材7としてナイロンシートを使用した。

【0061】その結果、現像スリーブ3上のトナーの帯電量は、現像部Cで+20 μ C/g、シール部材7の当接部B通過後、弾性ローラ15の当接部の手前で+5 μ C/gとなった。

【0062】実験例2

トナー8としてはポリエステル系樹脂を主成分とした非磁性トナーを使用し、弾性ブレード4としてウレタンゴムブレードを使用し、シール部材7としてフッ素樹脂系のシートを用い、上記と同様にして現像を行なったところ、現像スリーブ3上のトナーの帯電量は、現像部Cで-15 μ C/g、シール部材7の当接部B通過後、弾性ローラ15の当接部の手前で-5 μ C/gとなった。

【0063】比較例

トナー8として実験例1のスチレン／アクリル系樹脂を主成分とした非磁性トナーを使用し、弾性ブレード4及びシール部材7としてそれぞれ実験例2のウレタンゴムブレード及びフッ素樹脂系のシートを用いて現像を行なったところ、現像スリーブ3上のトナーの帯電量は、現像部Cで+20 μ C/g、シール部材7の当接部B通過後、弾性ローラ15の当接部の手前で+30 μ C/gとなった。

【0064】上記実験例1～2及び比較例のいずれの場合も、低温環境下で低画像比率の原稿を1000枚連続複写した。その結果、実験例1及び2では、最終画像に至るまで反射濃度1.3の良好な画像が維持でき、その後ベタ画像を複写してもゴースト画像は発生しなかった。これに対し比較例の場合は、100枚程度で反射濃度が1.3から0.9に低下し、ベタ画像でもゴーストが発生した。

【0065】実施例5

12

図6は、本発明の現像装置の実施例5の概略構成を示す断面図である。本実施例では、現像容器2の開口部下部のシール部材7と容器2の底部との間に任意の帯電装置18を配置し、シール部材7に現像スリーブ3上の未現像トナーの電荷を中和する極性のバイアスを印加して、シール部材7をトナーと反対極性の電荷付与部材にした。

【0066】このような方法によっても実施例4と同様な効果が得られる。更にシール部材7を電荷付与部材とするために、トナーの極性に依じてシール部材7の材質を選択するということが必要でなく、帯電装置18で印加するバイアスの極性を変化させるだけで、簡単に正、負の両極性のトナーに適用することができる利点もある。

【0067】本実施例において、トナー8としてスチレン／アクリル系樹脂の非磁性トナーを使用し、弾性ブレード4としてシリコンゴムブレードを使用し、シール部材7としてPETシートを使用して、帯電装置18からシール部材7にマイナスのバイアスを印加した条件で、現像し、画像形成を行なった。現像スリーブ3上の未現像トナーの帯電量を現像部Cで+20 μ C/g、シール部材7の当接部Bの通過後、弾性ローラ15の当接部の手前で+5 μ C/gにしたところ、低温環境下でも良好な画像を連続して複写できた。

【0068】実施例6

本実施例では、図5を参照して説明した実施例4において、トナー8に対してシール部材7の材料を選択する代わりに、シール部材7の現像スリーブ3との当接側にカーボンなどを分散した導電性の弾性層を設けたことが特徴である。

【0069】これによれば、シール部材7の弾性層の抵抗による電圧降下分、現像スリーブ3上の未現像トナーの帯電電荷が弾性層側に逃げるので、シール部材7自体をトナーと反対極性の電荷付与部材にしたのと同じような効果が得られ、実施例4のときと同様に、未現像のトナーの帯電量を現像部Cでの帯電量よりも低下させることができる。

【0070】本実施例において、シール部材7として厚さ200 μ mのウレタンゴムシート中にカーボンブラックを約30部分散させたものを用いたところ、現像スリーブ3上の未現像トナーの帯電量は、現像部Cで+20 μ C/g、シール部材7の当接部Bの通過後、弾性ローラ15の当接部の手前で+10 μ C/gに低下した。

【0071】

【発明の効果】以上説明したように、本発明の現像装置では、現像時に現像剤担持体と同方向に回転して、現像剤担持体上の未現像の成分現像剤としてのトナーを剥ぎ取ると共に現像容器内のトナーを新たに供給する第1の現像剤供給部材、又は回転することにより現像容器内のトナーを第1の現像剤供給部材の方向に供給する第

(8)

特開平 5 - 2 9 7 6 9 6

13

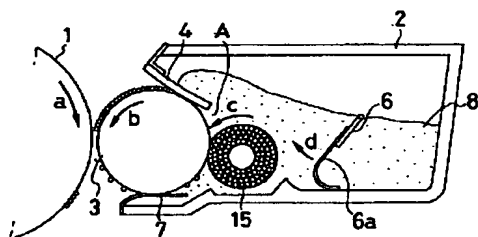
2の現像剤供給部材の一方又は両方を、非現像時の画像形成動作を開始したのち現像動作を開始するまでの間又は現像動作を終了したのち画像形成動作を終了するまでの間の少なくとも一方の間に、現像時とは逆方向に回転するようにしたので、トナーが弾性規制部材の現像剤担持体との当接部の近傍に凝集するのを防止し、且つ装置を高湿環境下で長期間放置したり、低画像比率の原稿の複写に使用し続けても、弾性規制部材の近傍へのトナーの供給量過多が生じるのを防止して、高濃度、広面積のベタ画像をムラやカブリを生じることなく忠実に再現できる。

【0072】又本発明の他の態様では、現像剤供給部材として上記の第1の供給部材のみが設置され、現像剤担持体に当接して現像容器内トナーを封止するシール部材が設置された現像装置において、トナーに対してシール部材の材料を選択する等により、現像剤担持体上の未現像トナーに対してその摩擦帯電極性と反対極性の摩擦帯電電荷を付与する電荷付与部材としての役目をシール部材に兼ねさせて、現像部と現像剤供給部材の現像剤担持体との当接部との間に配置したので、未現像トナーの帯電量を低減して上記の現像供給部材で容易に剥ぎ取ることができ、低湿環境下で小粒径トナーを使用し、低画像比率の原稿を連続して画像形成しても、高濃度、広面積のベタ画像を再現できる。

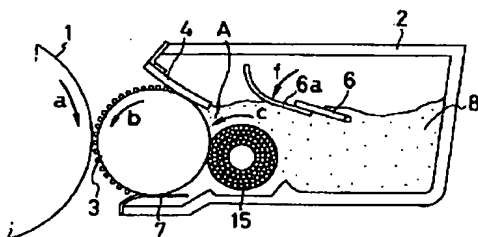
【図面の簡単な説明】

【図1】本発明の現像装置の実施例1の概略構成を示す

【図1】



【図3】



14

断面図である。

【図2】図1の現像装置の非現像時の状態を示す断面図である。

【図3】本発明の現像装置の実施例2における非現像時の状態を示す断面図である。

【図4】本発明の現像装置の実施例3における非現像時の状態を示す断面図である。

【図5】本発明の現像装置の実施例4の概略構成を示す断面図である。

【図6】本発明の現像装置の実施例5の概略構成を示す断面図である。

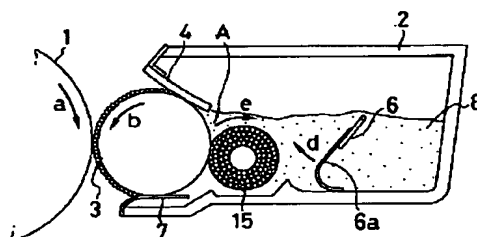
【図7】従来の現像装置の一例の概略構成を示す断面図である。

【図8】従来の現像装置の他の一例の概略構成を示す断面図である。

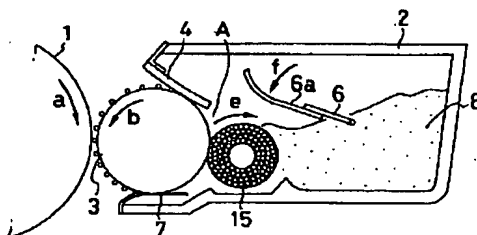
【符号の説明】

- 1 感光体
- 2 現像容器
- 3 現像スリーブ
- 4 弾性ブレード
- 5 ファーブラシローラ
- 6 トナー送り部材
- 7 シール部材
- 8 トナー
- 15 弾性ローラ
- 18 帯電装置

【図2】



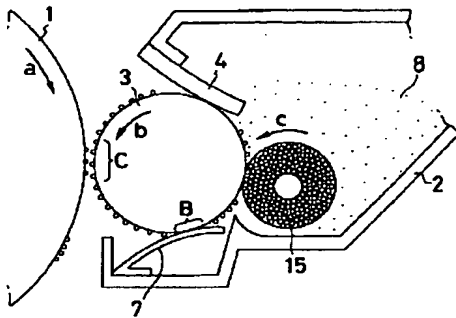
【図4】



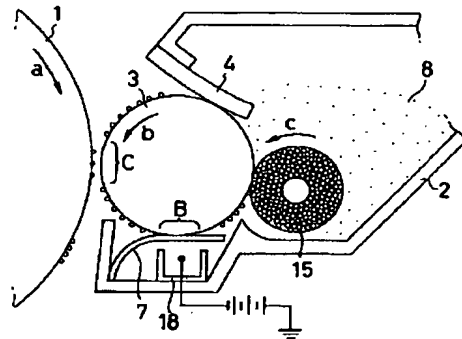
(9)

特開平 5 - 2 9 7 6 9 6

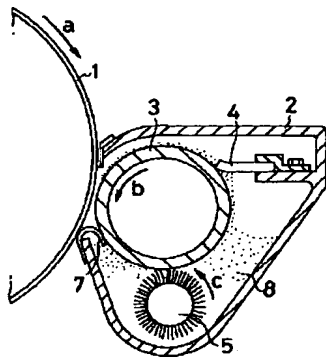
【図 5】



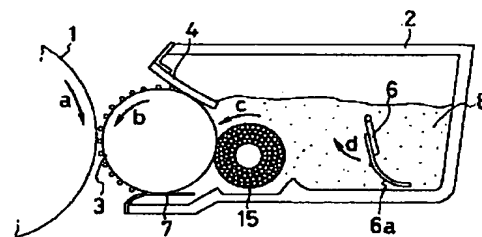
【図 6】



【図 7】



【図 8】



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